Report from the Airplane Performance Harmonization Working Group

Issue: Runway Alignment Distance

Rule Section: FAR 121.189, 135.379/JAR-OPS 1.490

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

Where the airplane must be turned onto the active runway at or in front of the runway threshold, some of the runway length that would otherwise be available for the takeoff run must be used to align the airplane in the proper direction for takeoff. The portion of the runway behind the airplane is no longer available for use as part of the takeoff or accelerate-stop distance. If this alignment distance is not taken into account when showing compliance with the applicable takeoff limitations, the airplane could be taken off at weights for which the remaining runway length does not provide the intended safety margins for a takeoff or rejected takeoff.

This issue has been discussed and debated many times over the last 10-15 years. The FAA has received recommendations and advice from the U. S. National Transportation Safety Board (NTSB) and an industry/regulatory authority task force to require that runway alignment distance be taken into account when showing compliance with the takeoff limitations. Following an investigation of a runway overrun accident that occurred on May 21, 1988, the NTSB recommended that the FAA "require that operators of large turbojet transport category airplanes add the distance required for runway turn-on and takeoff alignment to the field length distances as determined from data in the approved flight manuals."

A Rejected Takeoff Safety Enhancement task force consisting of airplane operators and manufacturers, regulatory authorities, and pilots issued a recommendation in 1990 for the FAA to issue "an Advisory Circular to delineate various ways of accounting for runway alignment distance." A Takeoff Safety Training Aid developed jointly by the FAA and industry, and made available in 1994 by FAA Advisory Circular 120-62, states, "Correction to the available runway length can be made to the takeoff analysis on those runways where it is not possible to position the airplane at the beginning of the published distance." Data are provided in the training aid for making this correction. In addition, FAA order 8400.10, "Air Transportation Operations Inspector's Handbook," notes that "[a] significant error may be introduced if this distance is not subtracted from the available runway distance when takeoff performance is computed." Inspectors are advised to ensure that operators have appropriate guidance for flightcrews.

During the rulemaking process leading up to the adoption of the "Improved Standards for Determining Rejected Takeoff and Landing Performance" (63 *Federal Register* 8298), the FAA had considered adding a requirement for Part 121/135 operators to take runway alignment distance into account when determining the maximum allowable takeoff

weight from a given runway. Due to the controversial nature of this issue, the FAA decided to promulgate the final rule without including the runway alignment distance provision, and to add this issue to the FAA/JAA harmonization work program. The Performance Harmonization Working Group was tasked with recommending whether to adopt a requirement for operators to take into account any distance needed to align the airplane on the runway in the direction of takeoff (*64 Federal Register 202*).

2 - What are the current FAR and JAR standards relative to this subject? [Reproduce the FAR and JAR rules text as indicated below.]

Current FAR text:

Part 121

FAR 121.189 Airplanes: Turbine engine powered: Takeoff limitations.

(e) In determining maximum weights, minimum distances, and flight paths under paragraphs (a) through (d) of this section, correction must be made for the runway to be used, the elevation of the airport, the effective runway gradient, the ambient temperature and wind component at the time of takeoff, and, if operating limitations exist for the minimum distances required for takeoff from wet runways, the runway surface condition (dry or wet). Wet runway distances associated with grooved or porous friction course runways, if provided in the Airplane Flight Manual, may be used only for runways that are grooved or treated with a porous friction course (PFC) overlay, and that the operator determines are designed, constructed, and maintained in a manner acceptable to the Administrator.

Part 135

FAR 135.379 Large transport category airplanes: Turbine engine powered: Takeoff limitations.

(e) In determining maximum weights, minimum distances, and flight paths under paragraphs (a) through (d) of this section, correction must be made for the runway to be used, the elevation of the airport, the effective runway gradient, the ambient temperature and wind component at the time of takeoff, and, if operating limitations exist for the minimum distances required for takeoff from wet runways, the runway surface condition (dry or wet). Wet runway distances associated with grooved or porous friction course runways, if provided in the Airplane Flight Manual, may be used only for runways that are grooved or treated with a porous friction course (PFC) overlay, and that the operator determines are designed, constructed, and maintained in a manner acceptable to the Administrator.

Current JAR text:

JAR-OPS 1.490 Take-off

(c) When showing compliance with sub-paragraph (b) above, an operator must take account of the following:

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(6) The loss, if any, of runway length due to alignment of the aeroplane prior to take-off.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed? [Reproduce text from issue papers, special conditions, policy, certification action items, etc., that have been used relative to this issue]

N/A

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in? [Explain the differences in the standards or policy, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]

Currently, the Part 121/135 operating rules do not specifically require that the distance required to align the airplane on the runway for takeoff be taken into account in determining allowable takeoff weights. In contrast to the FAA requirements, JAR-OPS 1 does specifically require operators to take into account the loss, if any, of runway length due to alignment of the airplane prior to takeoff.

Taking into account the runway alignment distance may result in reducing the maximum weight that can be taken off from that runway. Because the runway length is fixed (unless a longer runway is available for use at that airport), the airplane's takeoff weight may have to be reduced due to the decrease in available runway length. If the number of passengers or amount of cargo to be carried must be reduced to reduce the airplane's takeoff weight, an airplane operator would suffer a loss of revenue.

The JAR standards provide a higher level of safety than the FAR when operating from runways where a portion of the runway distance must be used to align the airplane on the runway. In achieving this higher level of safety, the JAR standards impose an economic burden on JAR operators that is not borne by FAR operators.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

N/A – The FAR does not contain a standard for runway alignment distance, so there is no applicable means of compliance.

5 – What is the proposed action? [Describe the new proposed requirement, or the proposed change to the existing requirement, as applicable. Is the proposed action to introduce a new standard, or to take some other action? Explain what action is being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen for each proposed action.]

The proposed action is to harmonize to the JAR standard. The requirement for operators to take into account the distance needed to align the airplane on the runway for takeoff would be added to Parts 121 and 135 of the FAR. Sections 121.189(e) and 135.379(e) would be reformatted to list each of the items for which correction must be made in separate subparagraphs. Sections 121.189(e)(1) and 135.379(e)(1) through 121.189(e)(4) and 135.379(e)(4) would contain items currently in §§ 121.189(e) and 135.379(e), respectively, except for the amendments related to wet and contaminated runways and other minor changes proposed in Working Group Reports 2, 4, and 5.

This proposal would add, as a new §§ 121.189(e)(5) and 135.379(e)(5), a requirement to correct for the loss, if any, of takeoff run available, takeoff distance available, and accelerate-stop distance available due to aligning the airplane on the runway prior to takeoff. Although this text is somewhat different than the JAR text, it carries the same intent. The text proposed for the FAR is more consistent with the wording used in §§ 121.189(c) and 135.379(c) for which this correction applies. Also, depending on runway configuration, the correction may not be the same for each of the applicable distances (the takeoff run available, takeoff distance available, and accelerate-stop distance available).

For each proposed change from the existing standard, answer the following questions:

6 - What should the harmonized standard be? [Insert the proposed text of the harmonized standard here]

The proposed amended FAR Parts 121, 135, and JAR-OPS 1 standards are shown below. (Note: No changes are being proposed for the JAR.)

FAR Part 121

FAR 121.189 Airplanes: Turbine engine powered: Takeoff limitations.

(e) In determining maximum weights, minimum distances and flight paths under paragraphs (a) through (d) of this section, correction must be made for:

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(6) The loss, if any, of takeoff run available, takeoff distance available, and accelerate-stop distance available due to aligning the airplane on the runway prior to takeoff.

FAR Part 135

FAR 135.379 Large transport category airplanes: Turbine engine powered: Takeoff limitations.

(e) In determining maximum weights, minimum distances and flight paths under paragraphs (a) through (d) of this section, correction must be made for:

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(6) The loss, if any, of takeoff run available, takeoff distance available, and accelerate-stop distance available due to aligning the airplane on the runway prior to takeoff.

JAR-OPS 1

JAR-OPS 1.490 Take-off

(c) When showing compliance with sub-paragraph (b) above, an operator must take account of the following:

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(6) The loss, if any, of runway length due to alignment of the aeroplane prior to take-off.

7 - How does this proposed standard address the underlying safety issue (identified under #1)? [Explain how the proposed standard ensures that the underlying safety issue is taken care of.]

The proposed standard continues to address the underlying safety issue in the same manner. The changes reflected in the proposed standard are consistent with other changes proposed by the Airplane Performance Harmonization Working Group for the performance operating limitations.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

The proposed standard would increase the level of safety relative to the current FAR for takeoffs from runways where part of the runway length must be used to align the airplane on the runway for takeoff. Currently, the FAR does not require operators to take into account the loss of distance available to perform the takeoff. The proposed standard would require operators to take this loss of available runway length into account when determining the maximum weight that can be taken off from a given runway.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

Industry practice varies. Some operators already consider runway alignment distance using one of the methods described in the proposed advisory material. For these operators, the proposed standard would maintain the same level of safety. For operators who do not consider the effects of runway alignment distance and do not add comparable safety margins that are not otherwise required by the FAR, the proposed standard would increase the level of safety.

10 - What other options have been considered and why were they not selected? [Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable decrease in the level of safety, lack of consensus, etc.) Include the pros and cons associated with each alternative.]

The alternatives would be to harmonize on the current FAR standard or retain the current non-harmonized standards. Harmonizing on the current FAR standard would involve removing the runway alignment distance requirement from the JAR. This was unacceptable to the JAA, as it would result in a decrease in safety relative to the current JAR. Retaining the current non-harmonized standards was unacceptable because it would not address the unlevel playing field issue of an economic burden on JAR operators that is not borne by FAR operators. Also, it would be inappropriate from a safety standpoint to not take into account the distance used, if any, to align the airplane on the runway for takeoff.

11 - Who would be affected by the proposed change? [Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]

Operators and manufacturers of transport category airplanes could be affected by the proposed change. Airplane manufacturers would be requested by operators to provide data from which runway alignment distances could be determined. Airplane operators would need to adjust their takeoff analyses to include the consideration of runway alignment distances. Specific operations may be affected in that the airplane's takeoff weight may need to be reduced in order to comply with the proposed requirement.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted? [Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided. Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

To fully realize the benefits of harmonization, an acceptable means of compliance should be clearly identified and described in appropriate guidance material. The means of compliance should be simple to apply, allow flexibility in the specific manner of implementation, be applicable to any airplane that may be operated under Parts 121 or 135 on any runway/taxiway configuration to be encountered, and provide a reasonably accurate approximation of the distance that will be needed to align the particular airplane on the particular runway for takeoff.

Proposed Advisory Circular material addressing an acceptable means of compliance is included as an attachment to this working group report and is summarized below.

When determining a runway lineup distance correction, the position of the takeoff threshold, the runway/taxiway geometry, and the taxi maneuvering characteristics of the particular airplane type should be considered. Manufacturers typically provide alignment distance increments for 90 and 180 degree turns onto the takeoff runway. For airplanes for which the manufacturer has not provided such data, or for runway/taxiway configurations not represented by the manufacturer's data, the operator should use the best data available (e.g., airplane geometry or suitable adjustments to manufacturer-supplied data) to determine the appropriate runway alignment distance.

The alignment distance correction can be made directly to the available runway length, or can be taken into account in any other manner selected by the operator that gives equivalent results. For example, if an operator chooses to not take credit for the potential takeoff weight benefit for available clearway, and the effect of the uncredited clearway on takeoff weight is equal to or greater than the effect of the runway alignment distance correction, no additional correction is necessary. The presence of runway safety areas and other features that are not considered part of the declared takeoff or accelerate-stop distances, however, cannot be used to comply with the proposed requirement.

14 - How does the proposed standard compare to the current ICAO standard? [Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]

ICAO Annex 6- Part 1, 5.2.8.1 states, "In determining the length of the runway available, account shall be taken of the loss, if any, of runway length due to alignment of the aeroplane prior to takeoff." The proposed standard would incorporate the ICAO standard into FAR Part 121 and 135. The current FAR standards do not explicitly address this issue.

15 - Does the proposed standard affect other HWG's? [Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]

No.

16 - What is the cost impact of complying with the proposed standard? [Please provide information that will assist in estimating the change in cost (either positive or negative) of the proposed rule. For example, if new tests or designs are required, what is known with respect to the testing or engineering costs? If new equipment is required, what can be reported relative to purchase, installation, and maintenance costs? In contrast, if the proposed rule relieves industry of testing or other costs, please provide any known estimate of costs.]

There would not be a cost impact for those operators who currently take runway alignment distance into account when determining maximum takeoff weights. Operators who do not take runway alignment distance into account could suffer a loss of payload for each flight in which the takeoff weight must be reduced to comply with the proposed standard. Also, these operators will incur costs for modifying their takeoff analysis procedure to include consideration of runway alignment distance.

The annual costs of the proposed standard for 7 major U.S. air carriers who are not currently accounting for the effect of runway alignment distance on takeoff performance are estimated to be $ 29.9 million. This cost estimate is based on a 90 degree turn on to the runway with a minimum radius turn to align the airplane on the runway.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

N/A

18 - Does the HWG wish to answer any supplementary questions specific to this project? [If the HWG can think of customized questions or concerns relevant to this project, please present the questions and the HWG answers and comments here.]

No.

19 – Does the HWG want to review the draft NPRM prior to publication in the Federal Register?

Yes.

Attachment: Proposed Advisory Material for Runway Alignment Distance

Sections 121.189(e)(5)/135.379(e)(5) require correction for the loss, if any, of runway length due to alignment of the airplane prior to takeoff. No correction is needed for runways with displaced takeoff thresholds or turning aprons where there is enough room to align the airplane before crossing the takeoff threshold. Whenever the taxiway access to the runway to be used for takeoff does not allow positioning of the nose gear of the airplane at the runway threshold, a lineup correction must be made. The alignment distance correction can be made directly to the available runway length, or can be taken into account in any other manner selected by the operator that gives equivalent results.

For example, if an operator chooses to not take credit for the potential takeoff weight benefit for available clearway, and the effect of the uncredited clearway on takeoff weight is equal to or greater than the effect of the runway alignment distance correction, no additional correction is necessary. The presence of runway safety areas and other features that are not considered part of the declared takeoff or accelerate-stop distances, however, cannot be used to comply with the requirement to correct for runway alignment distance.

It is acceptable to determine the runway alignment distance from the taxiway/runway geometry, the airplane geometry, and the airplane taxi maneuvering characteristics. Because the takeoff distance/takeoff run are defined relative to the main gear position and the accelerate-stop distance is defined relative to the nose gear position, the runway length corrections can be different for showing compliance with the operating requirements related to takeoff distance/takeoff run and accelerate-stop distance. The runway length adjustment associated with the takeoff distance/takeoff run should be based on the initial distance from the main gear to the takeoff threshold. The runway length adjustment associated with the accelerate-stop distance should be based on the initial distance from the nose gear to the takeoff threshold.

Some manufacturers have provided distance adjustments for 90 and 180 degree turns onto the takeoff runway. These data are based on minimum turn radii consistent with the manufacturer's recommended turn procedures. Operators can use these data to develop lineup distance corrections appropriate to any runway turn geometry. For airplanes for which the manufacturer has not provided such data, the operator may use the best data available (e.g., airplane geometry and minimum turn radii) to determine the appropriate correction for runway alignment distance.